Projecting Vulnerability to Inundation due to Sea Level Rise in the San Francisco Bay and Delta

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Projected sea level rise over the next century will affect the shoreline of the Bay/Delta, newly inundating some areas and increasing the risk of levee failures in others.

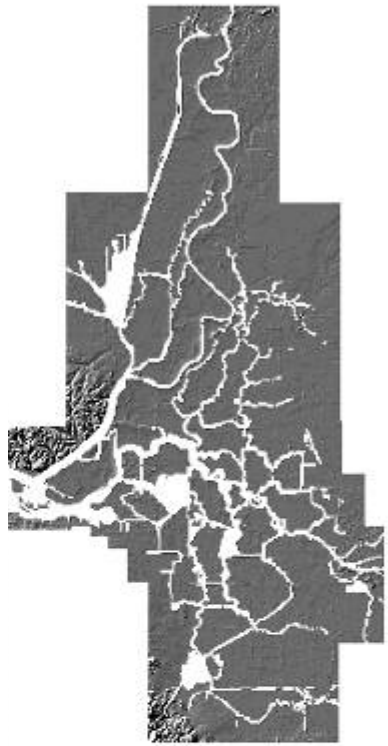
A new elevation dataset makes possible more accurate assessments of vulnerability than previously available.

Funded by through the California Energy Commission's Public Interest Energy Research Program (PIER) through the California Climate Change Center at Scripps Institution of Oceanography , and theCALFED Science Program CASCaDE Project.

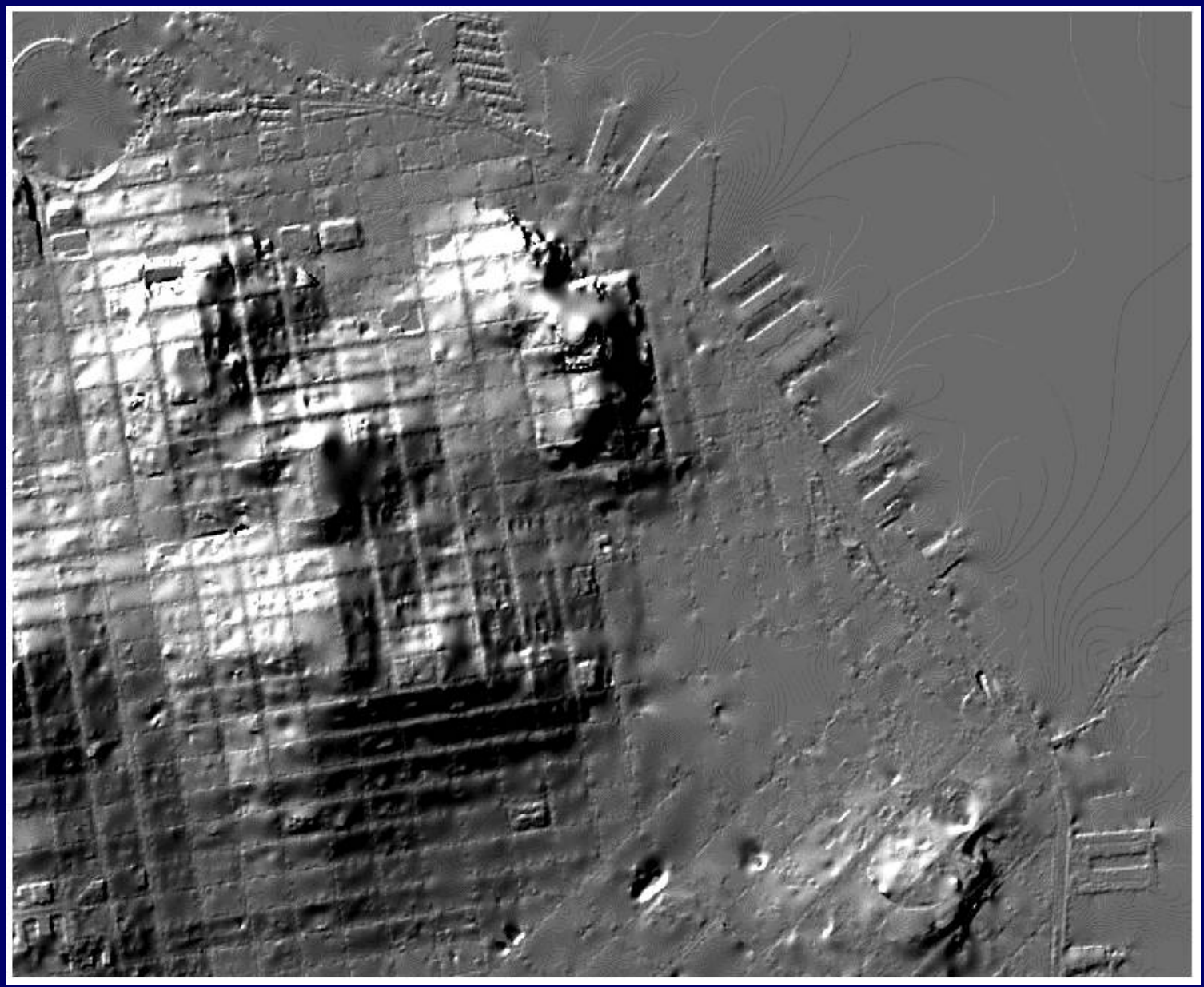
A new elevation dataset is essentially complete,

covering nearly the entire Bay and Delta.

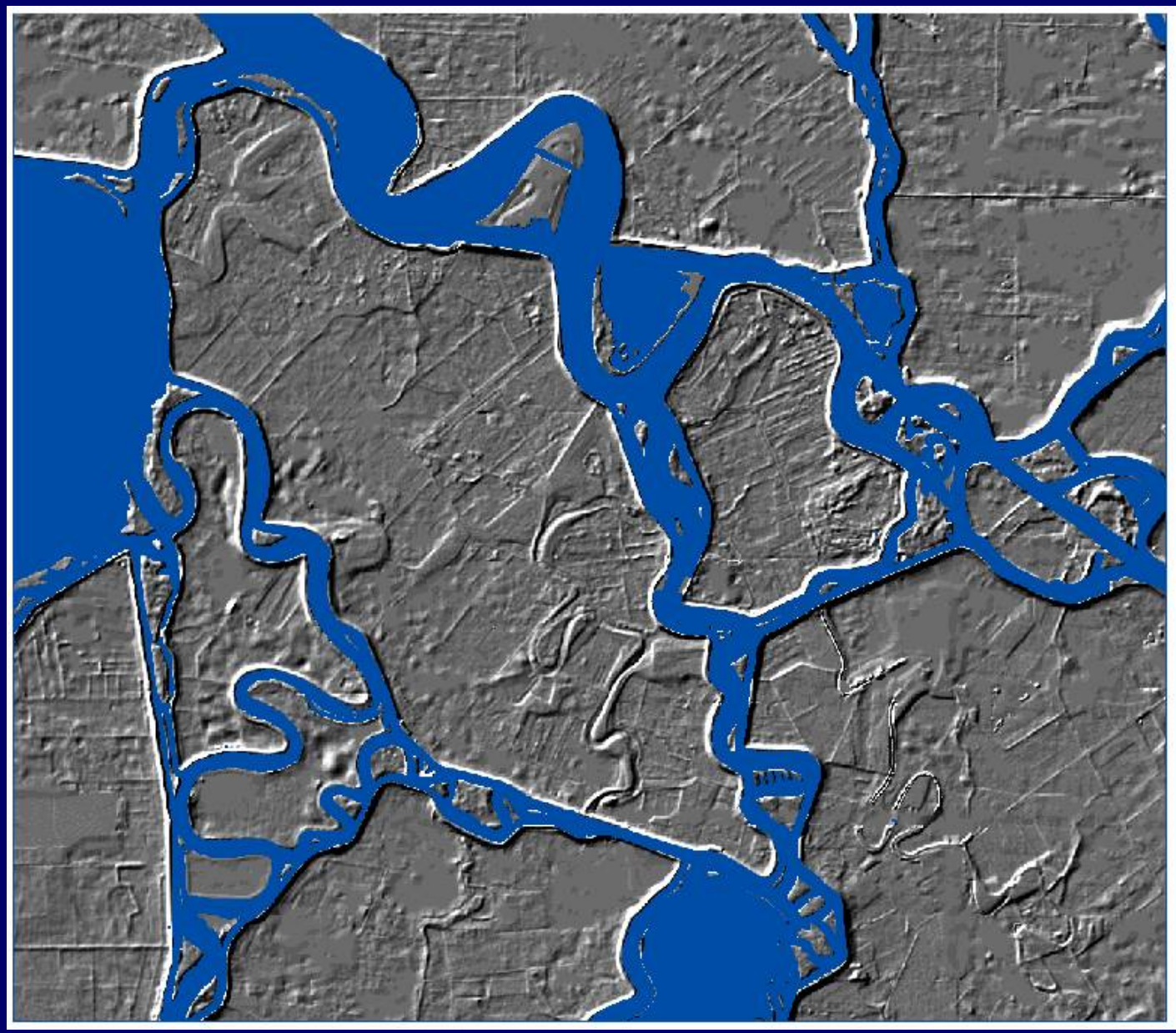
- Mainly photogrammetry-based
- 10-20 cm vertical accuracy
- Horizontal resolution 2-10m
- Work by Tom Coons, USGS (funded by CALFED)
- Napa R. watershed provided by Bill Dietrich and Ionut Iordache, UCB
- missing Petaluma R., Suisun marsh



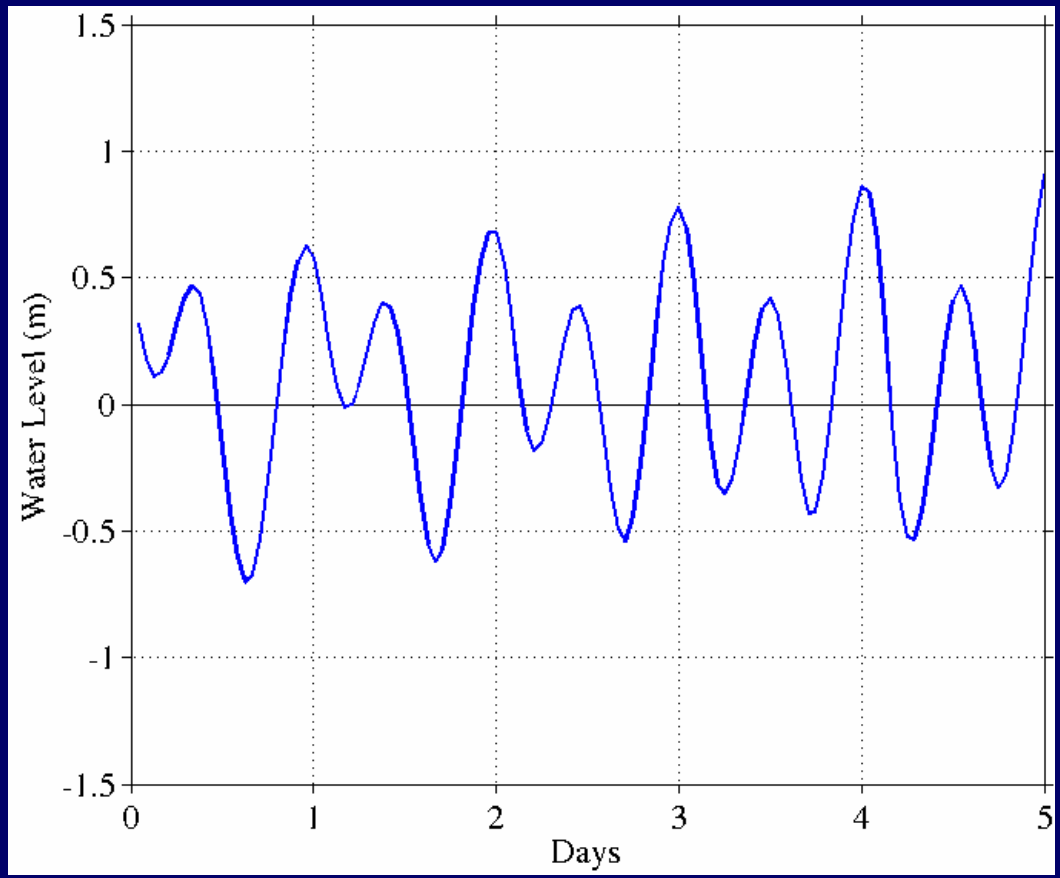
Sample Scene: SF business district and Embarcadero



Sample Scene: Delta islands and waterways

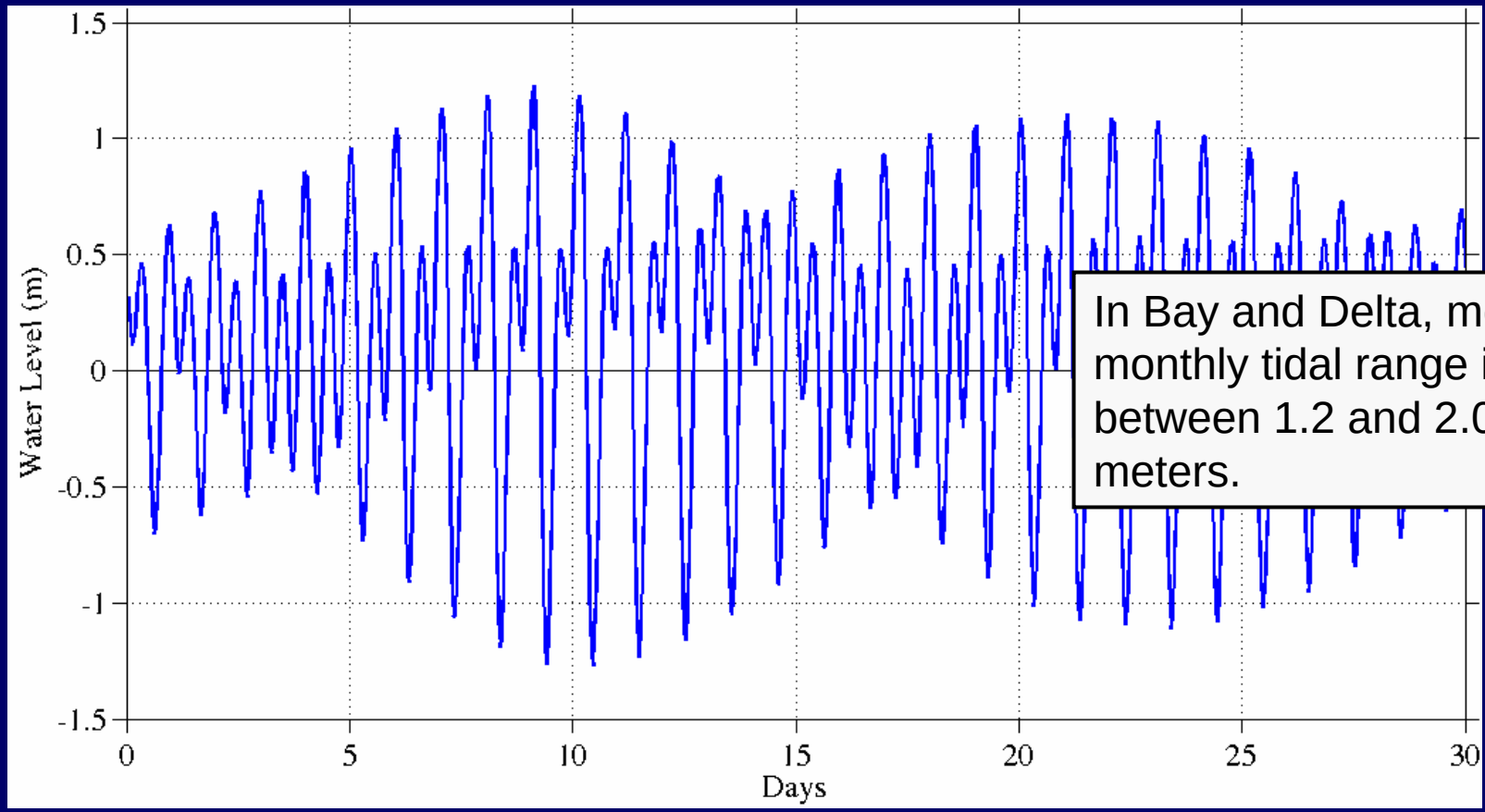


Tides vary around mean sea level on daily time scales…



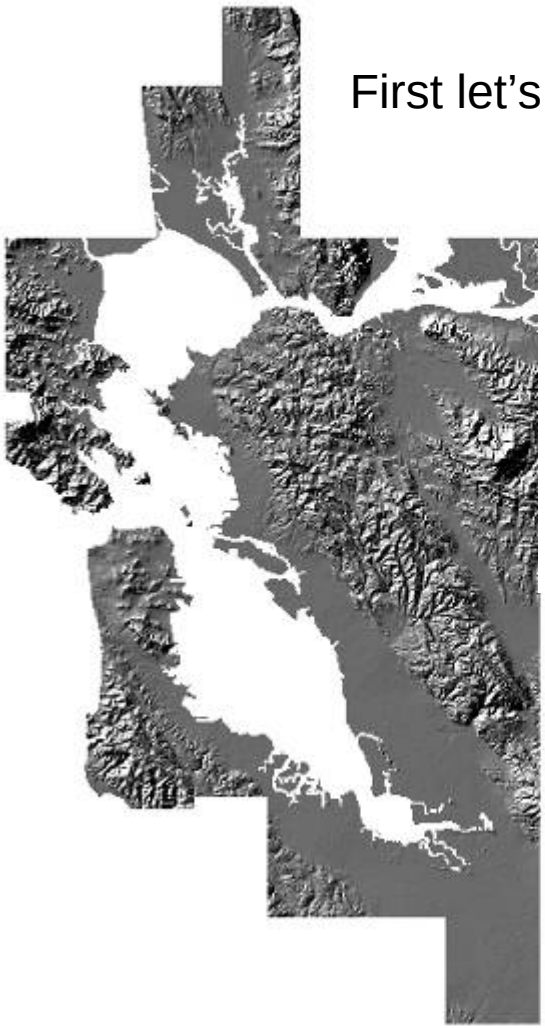
In Bay and Delta, mean daily tidal range is between 0.8 and 1.0 meter.

…and also on monthly time scales.



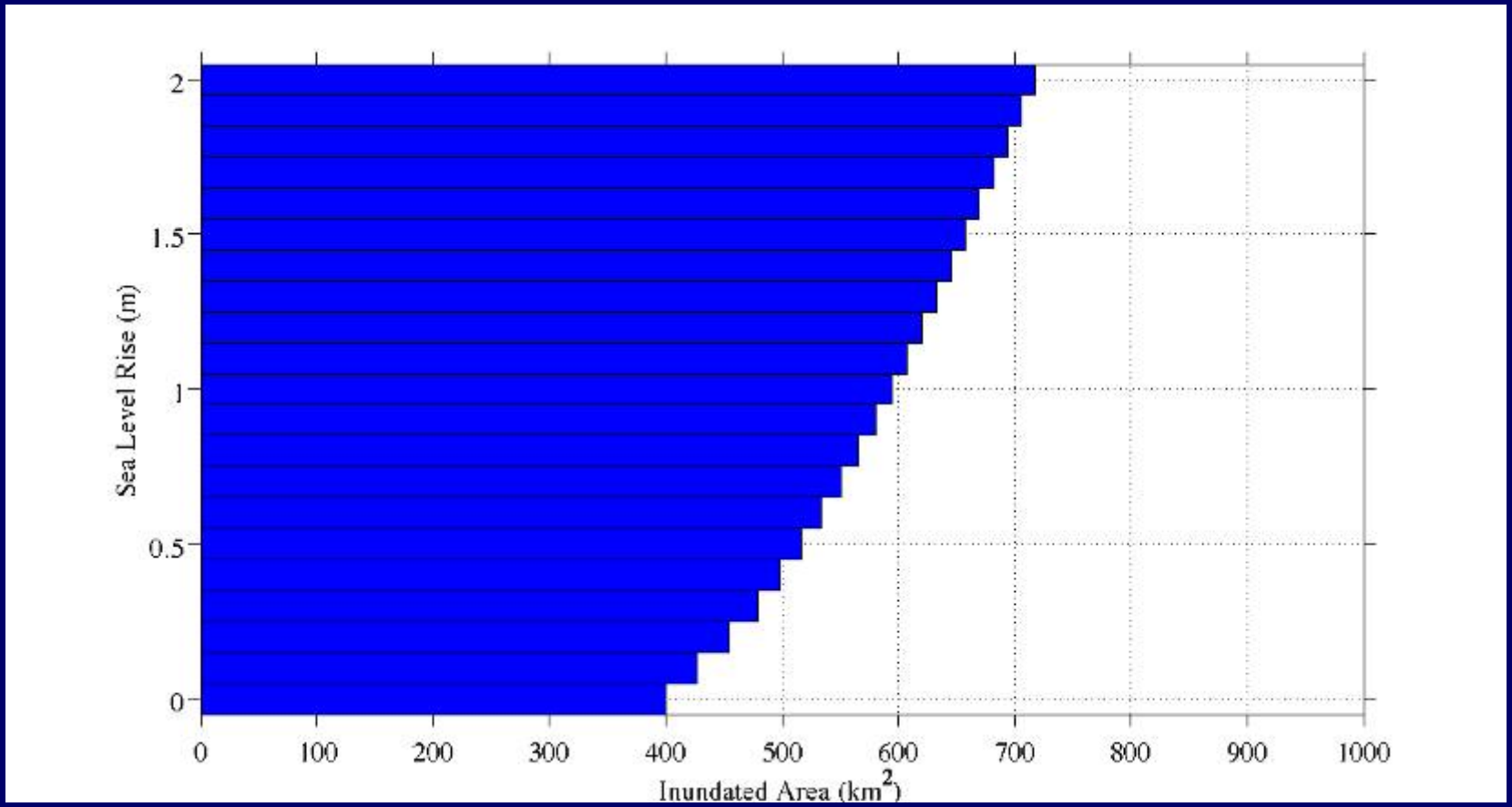
In Bay and Delta, mean monthly tidal range is between 1.2 and 2.0 meters.

What types of areas are at risk of tidal inundation with sea level rise?

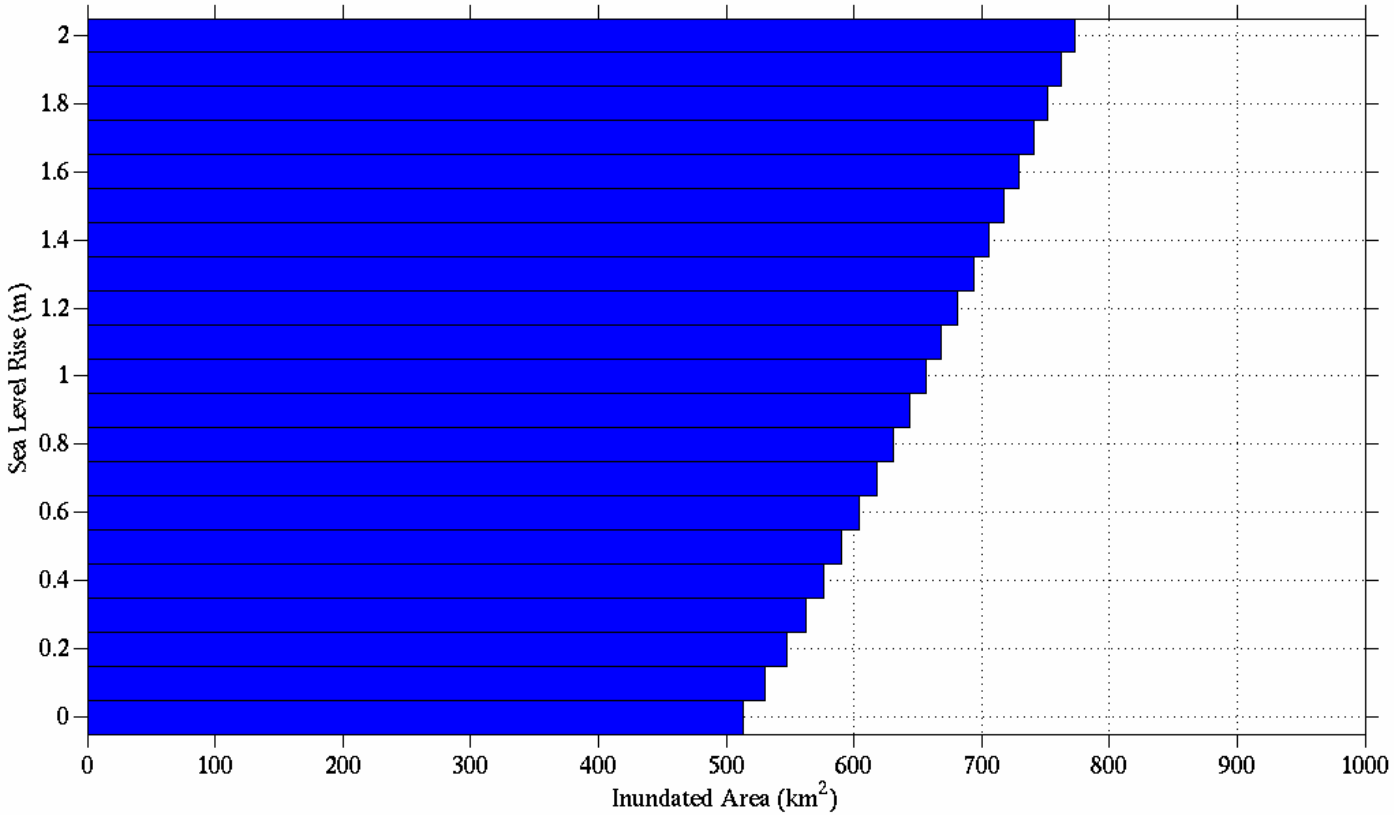


First let’s look at just the Bay

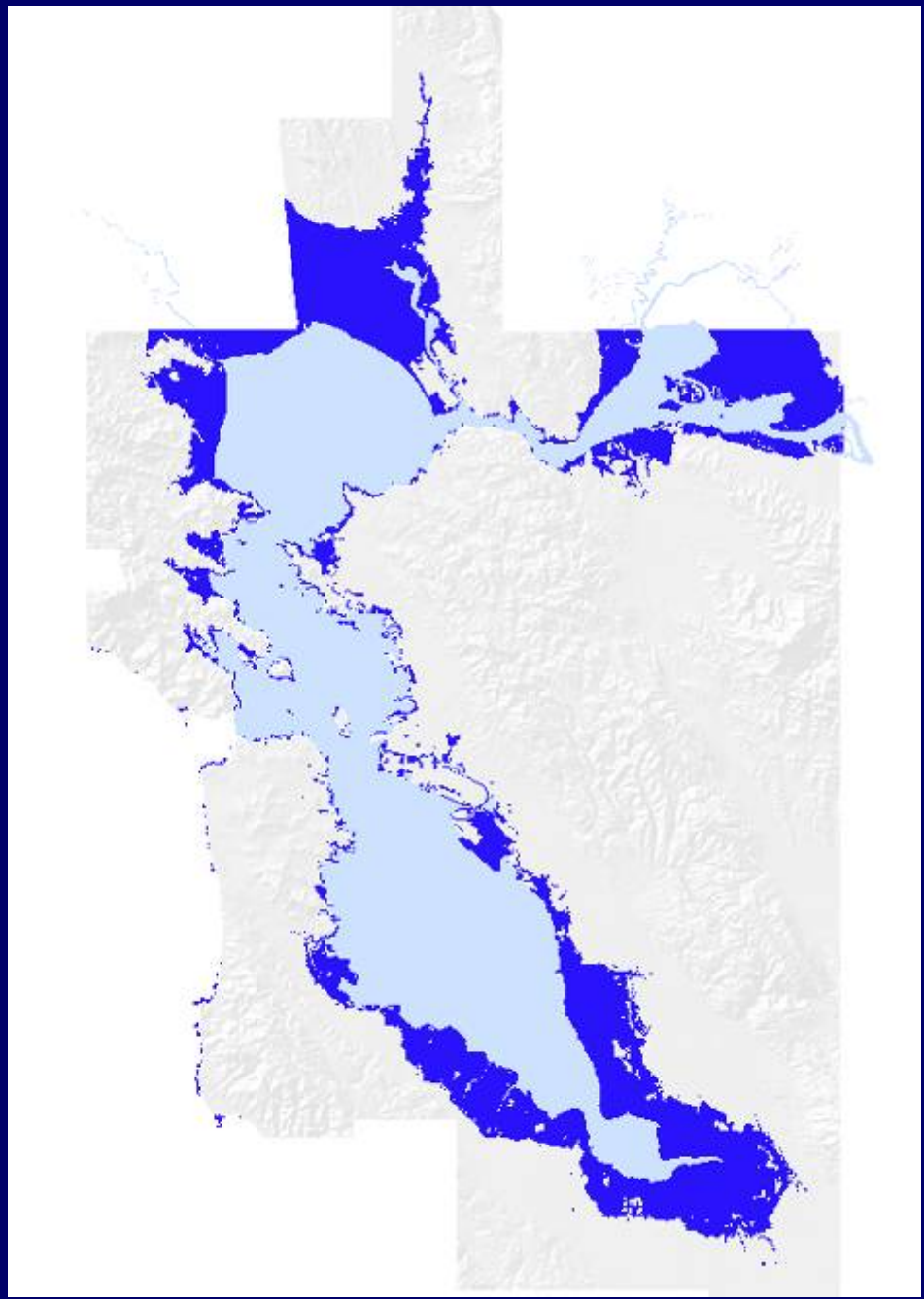
At the DAILY scale, about 400 km^2 of land are currently either inundated or protected by levees. This increases by 50% with a 1.0m sea level rise.



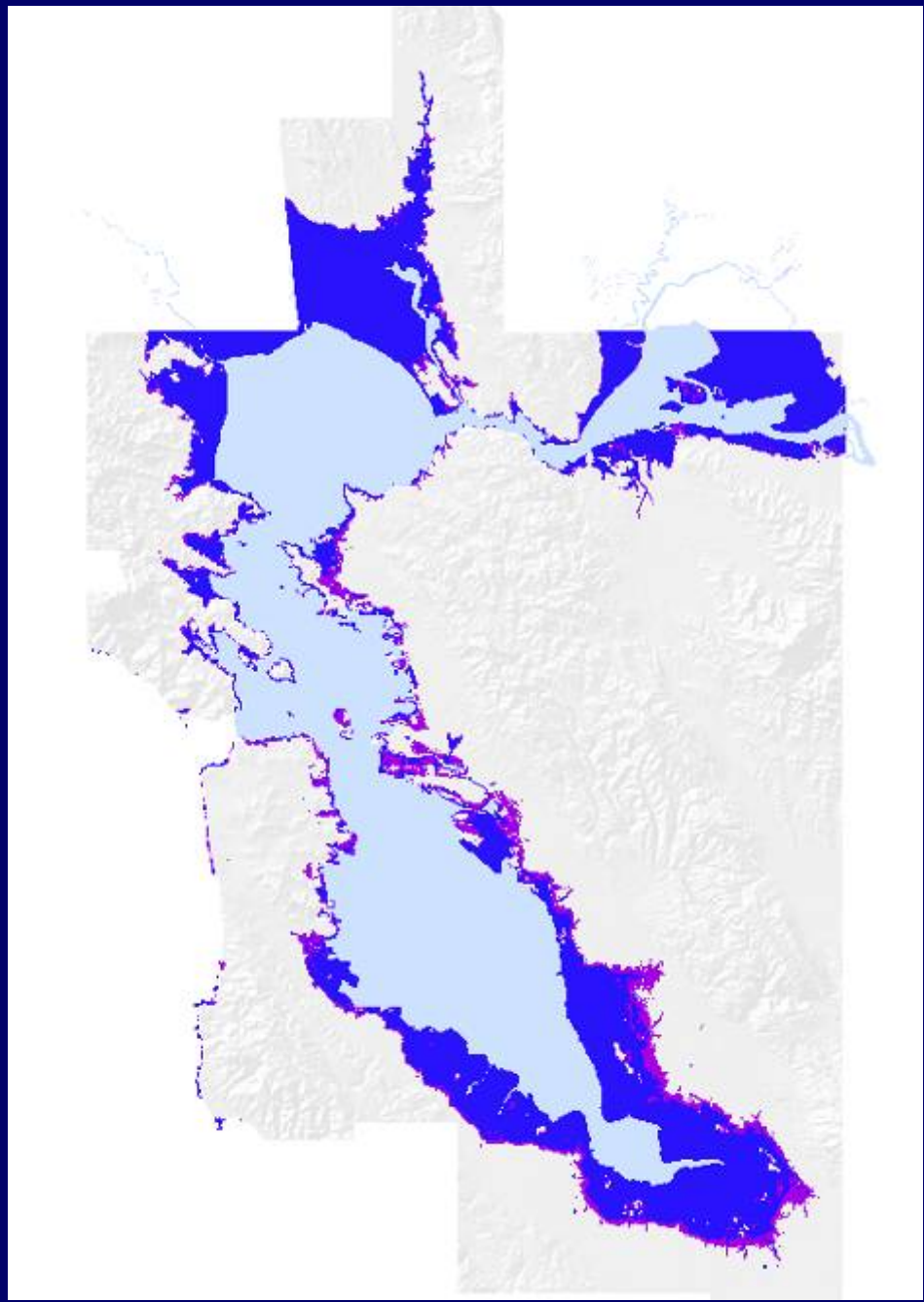
At the MONTHLY scale, about 500 km^2 of land are either inundated or protected by levees. This increases by 30% with a 1.0m sea level rise.



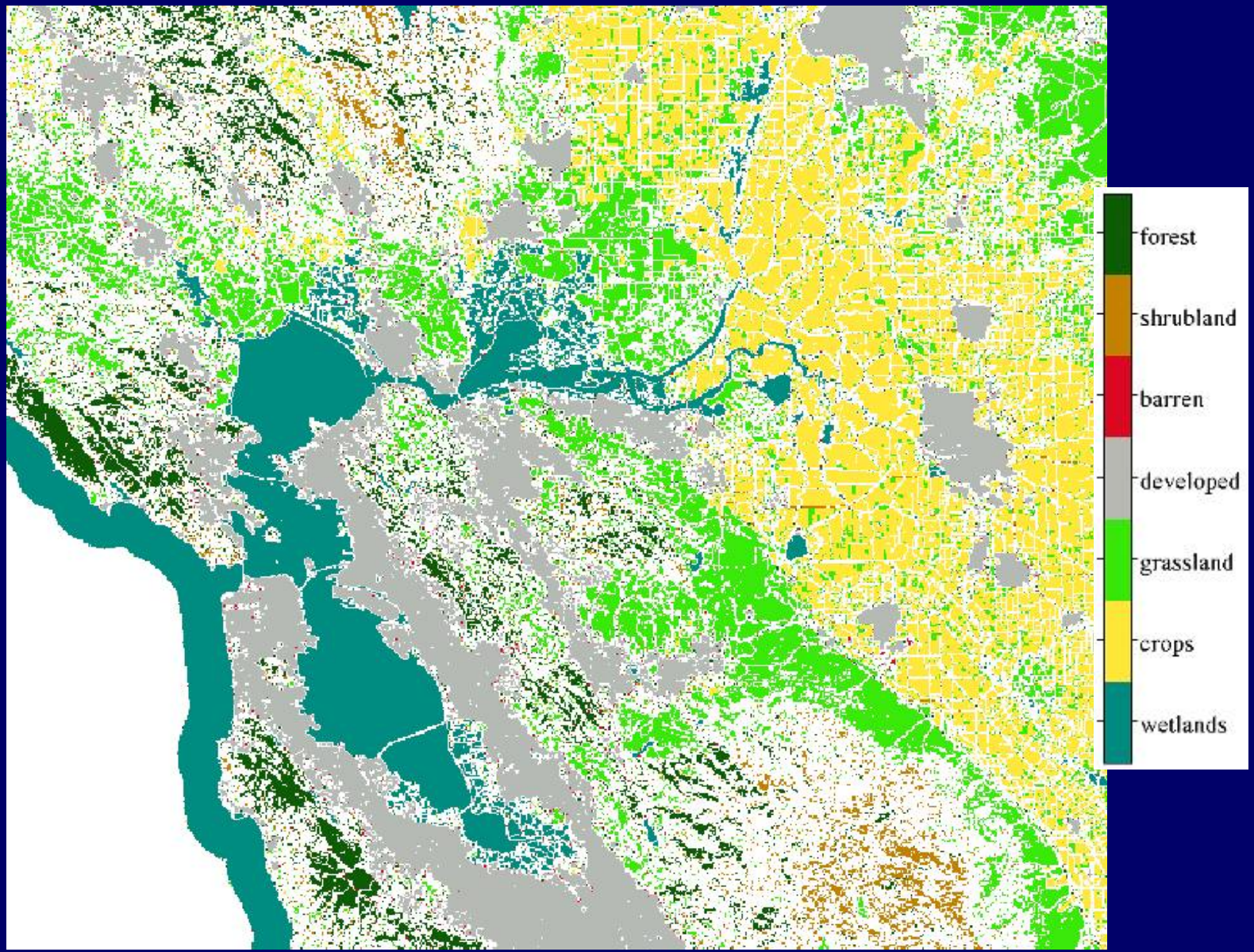
About 600 km^2 are inundated or at risk of DAILY inundation under a 1.0m sea level rise.



About 650 km^2 are inundated or at risk of MONTHLY inundation under a 1.0m sea level rise.

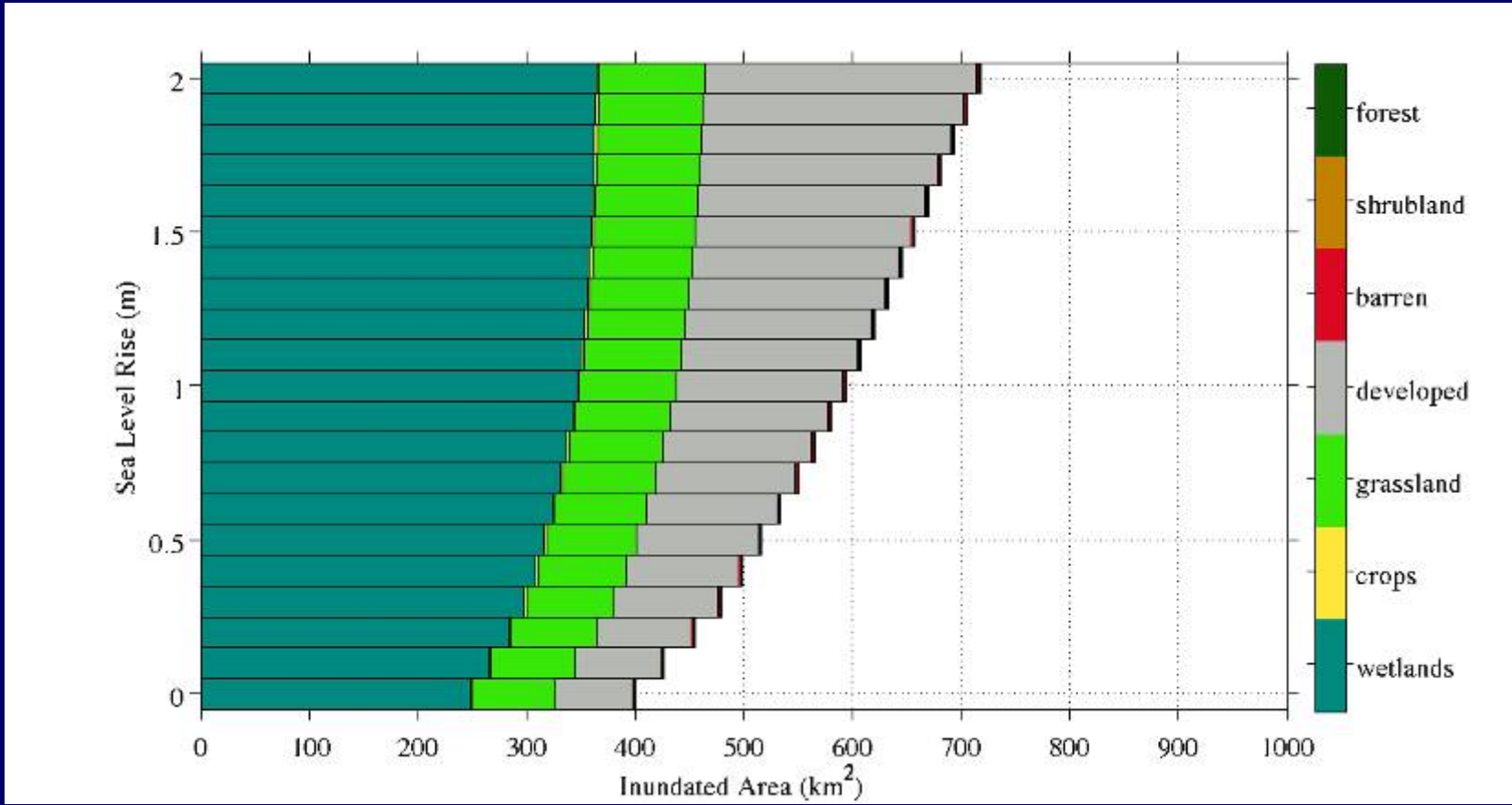


An updated land cover dataset has also become available: NLCD2001

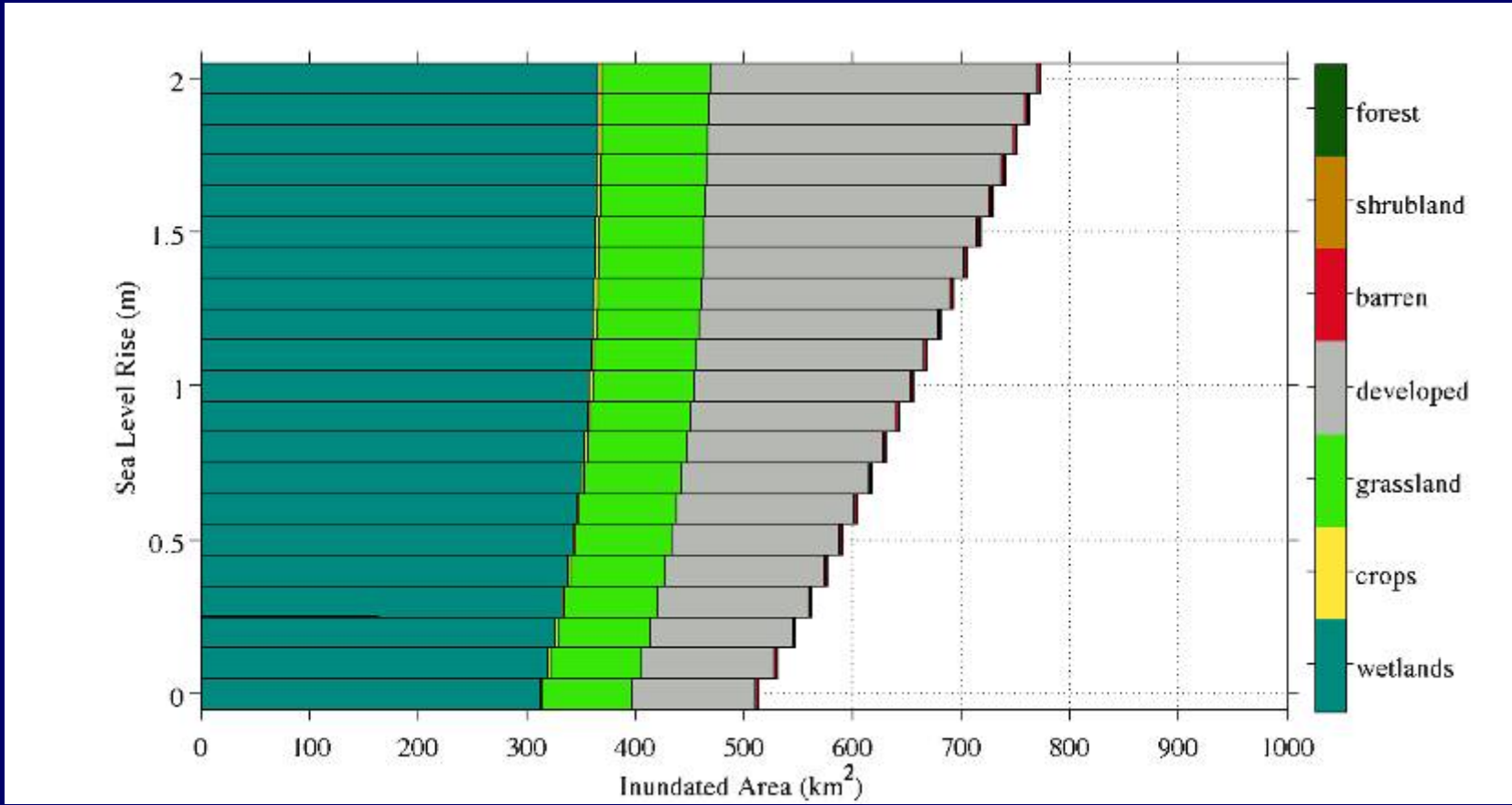


http://www.mrlc.gov

Areas of different land cover types subject to DAILY inundation

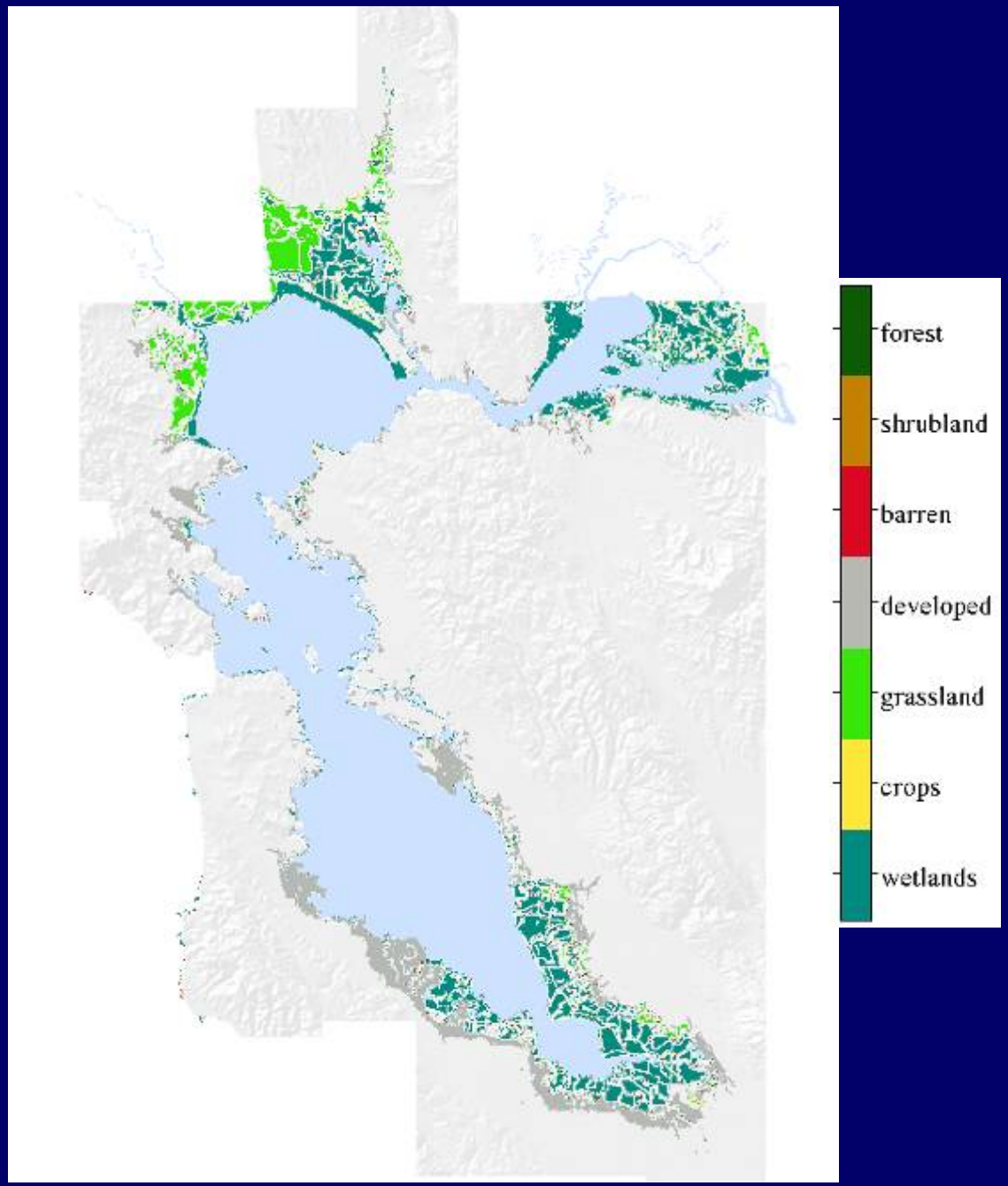


Areas of different land cover types subject to MONTHLY inundation

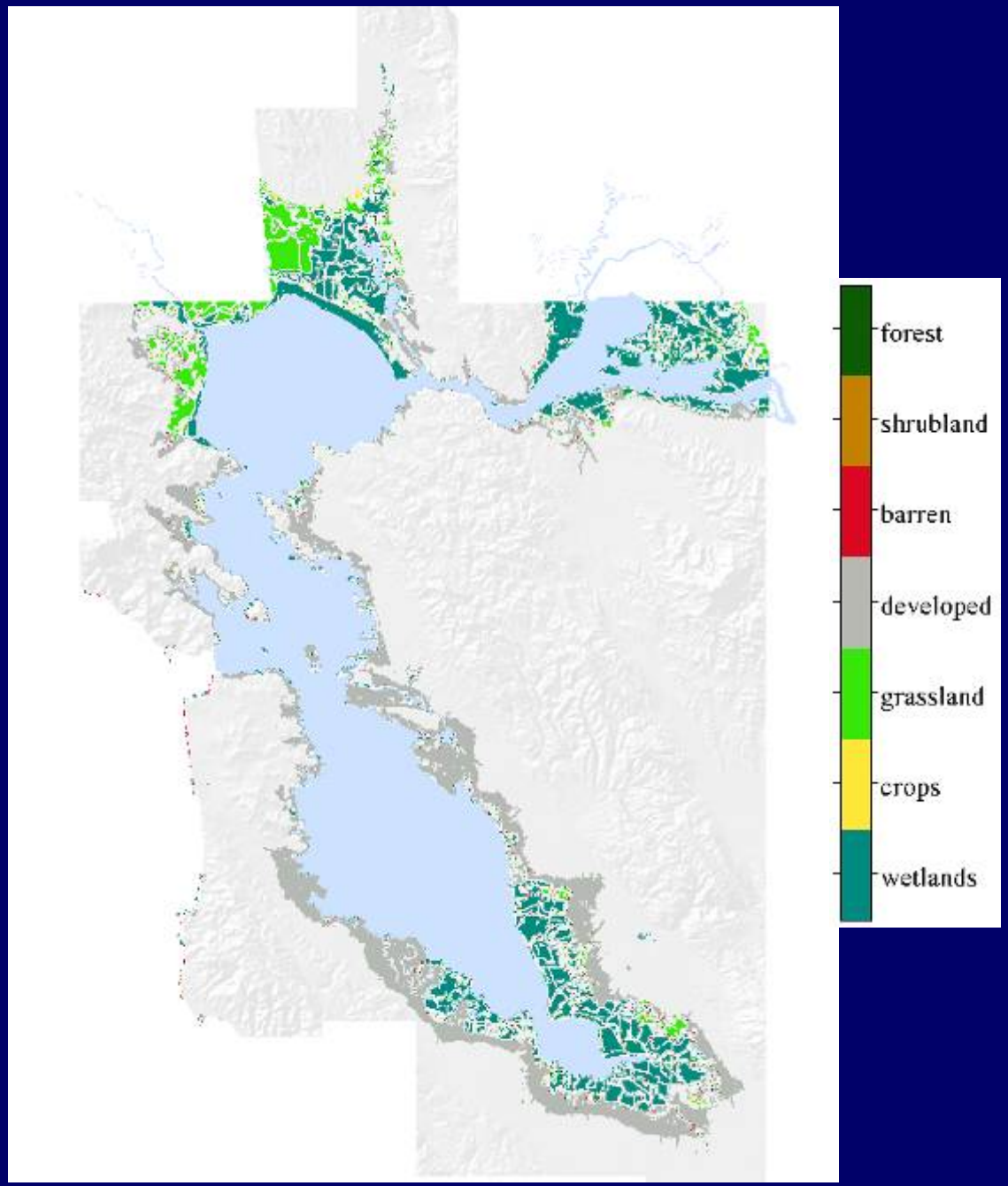


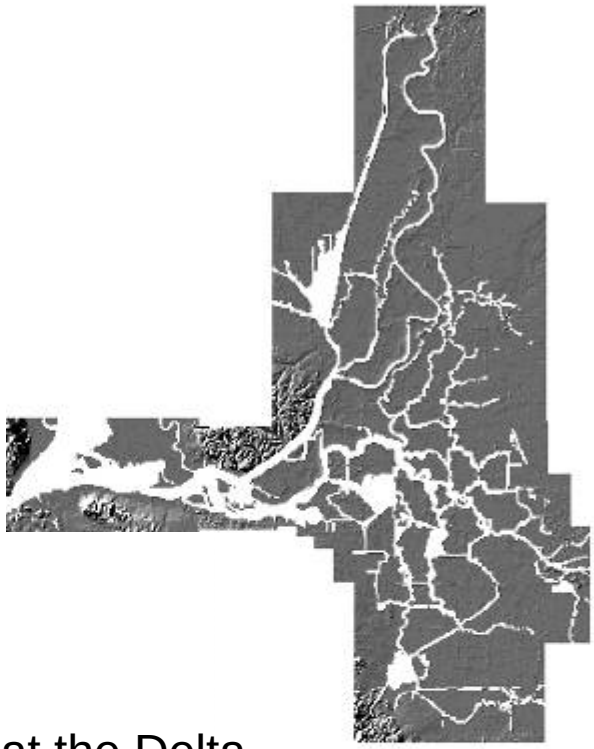
Marsh, grasslands– little change. Developed areas-- big increase!

Areas at risk of DAILY inundation under 1.0m sea level rise



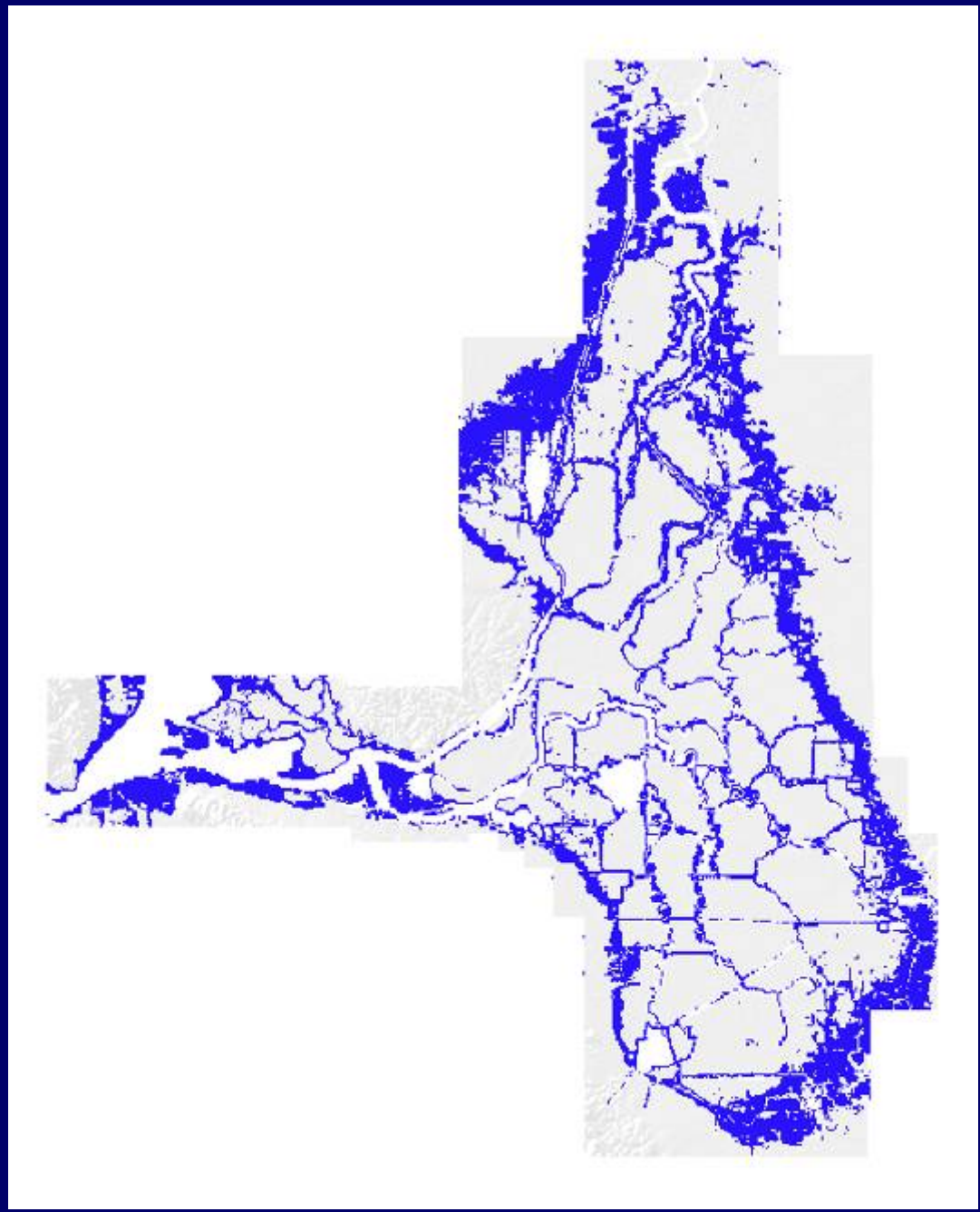
Areas at risk of MONTHLY inundation under 1.0m sea level rise



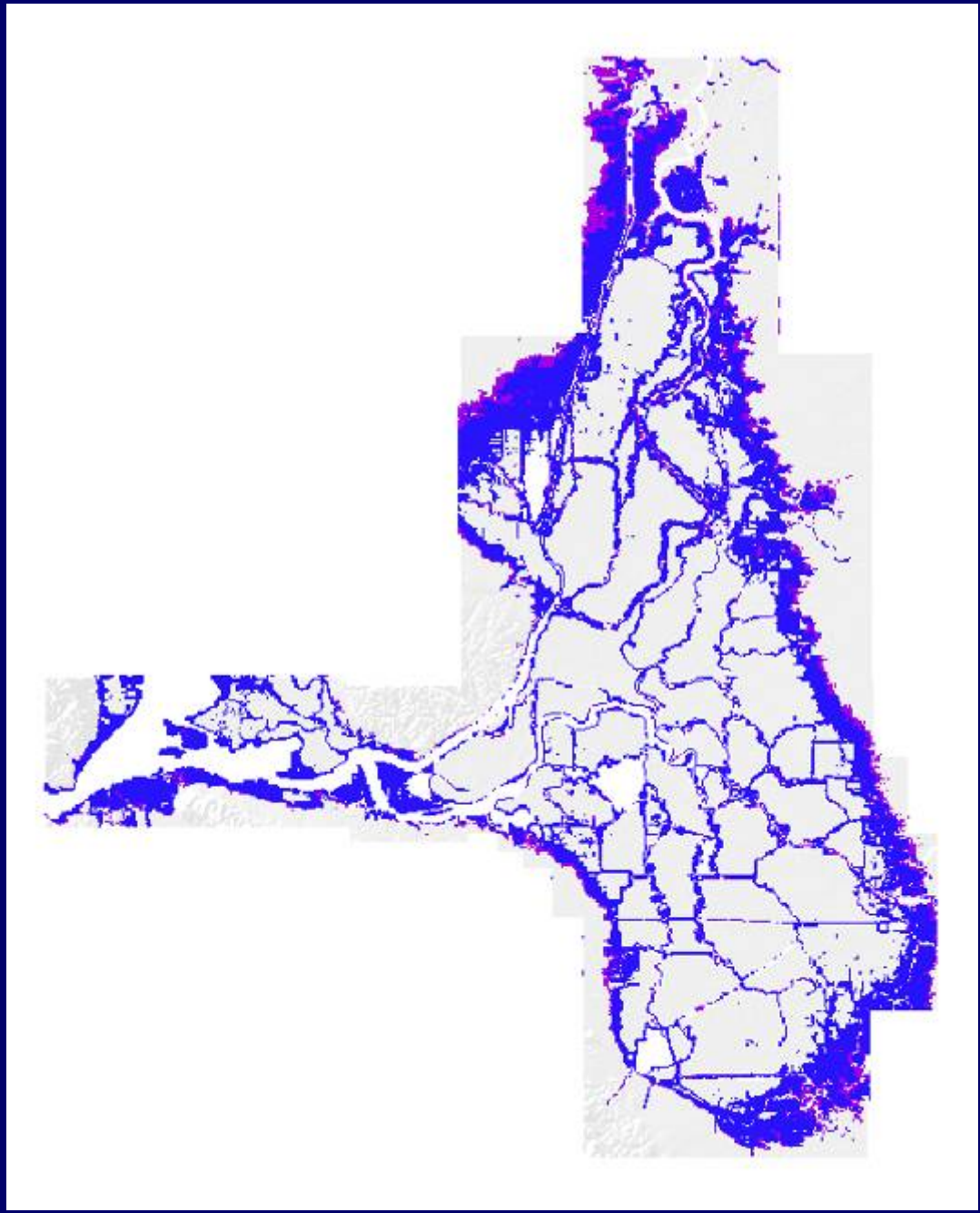


Next let’s look at the Delta

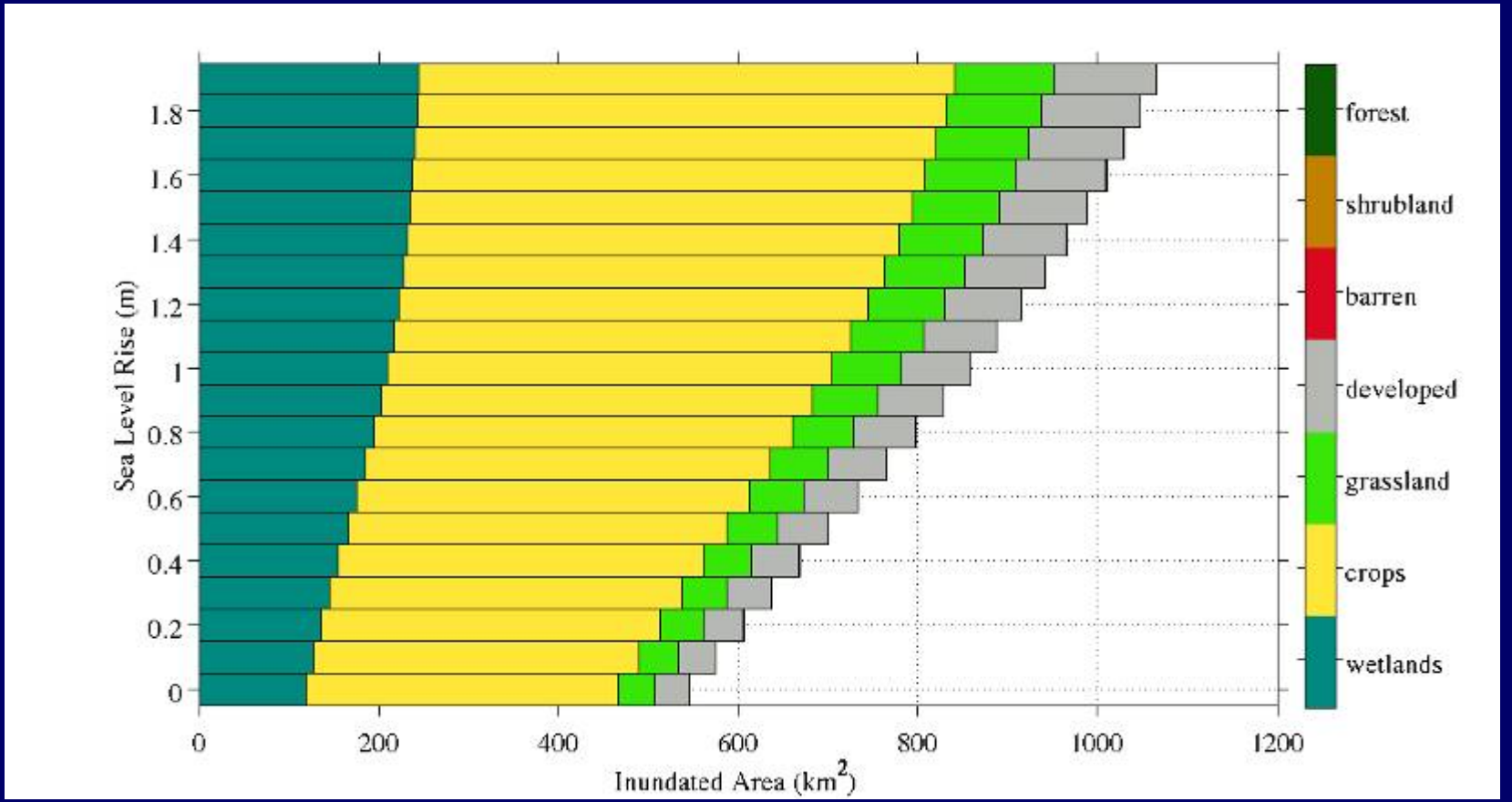
About 850 km^2 are inundated or at risk of DAILY inundation under a 1.0m sea level rise.



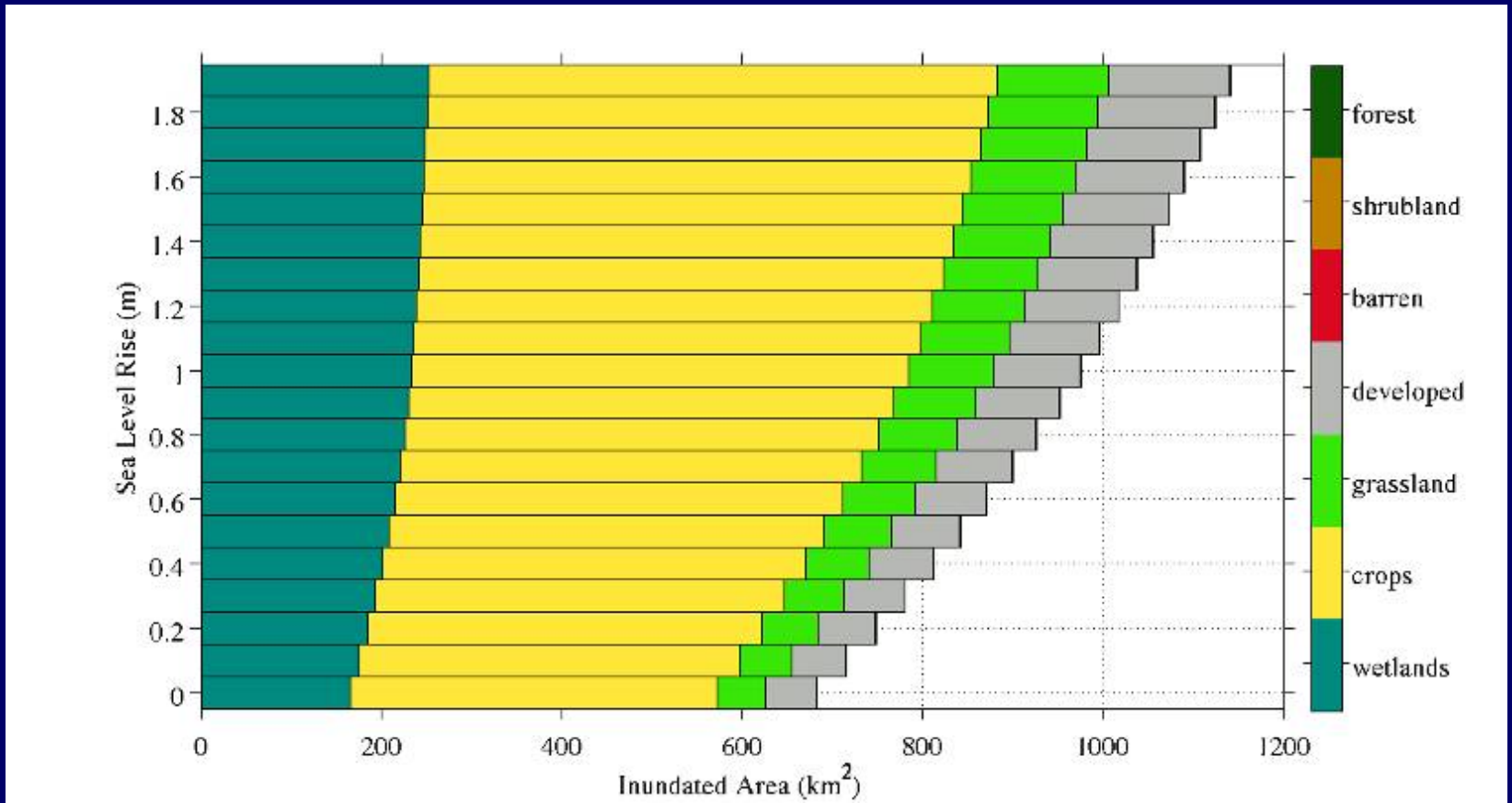
About 1,000 km^2 are inundated or at risk of MONTHLY inundation under a 1.0m sea level rise.



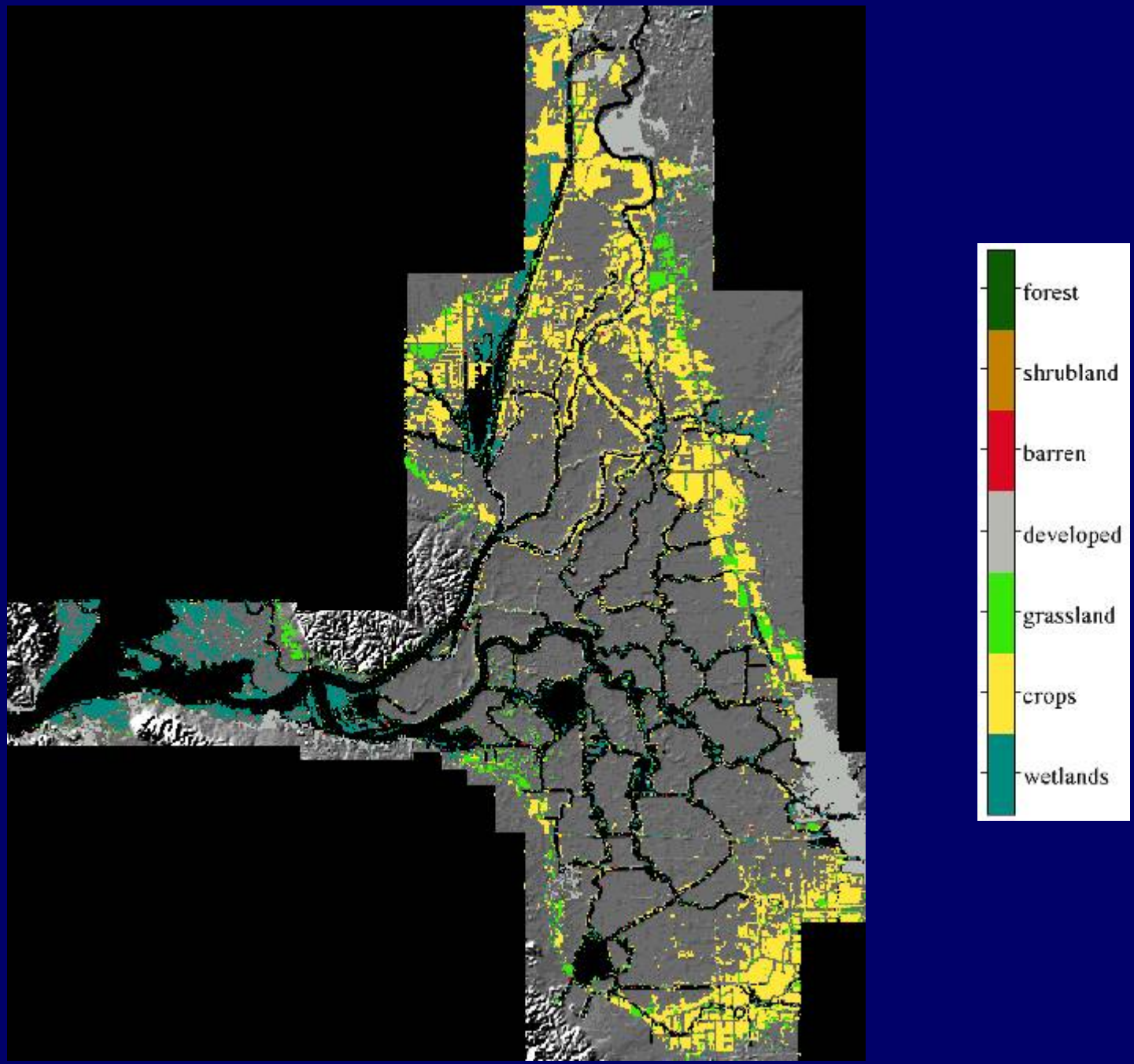
Areas of different land cover types subject to DAILY inundation



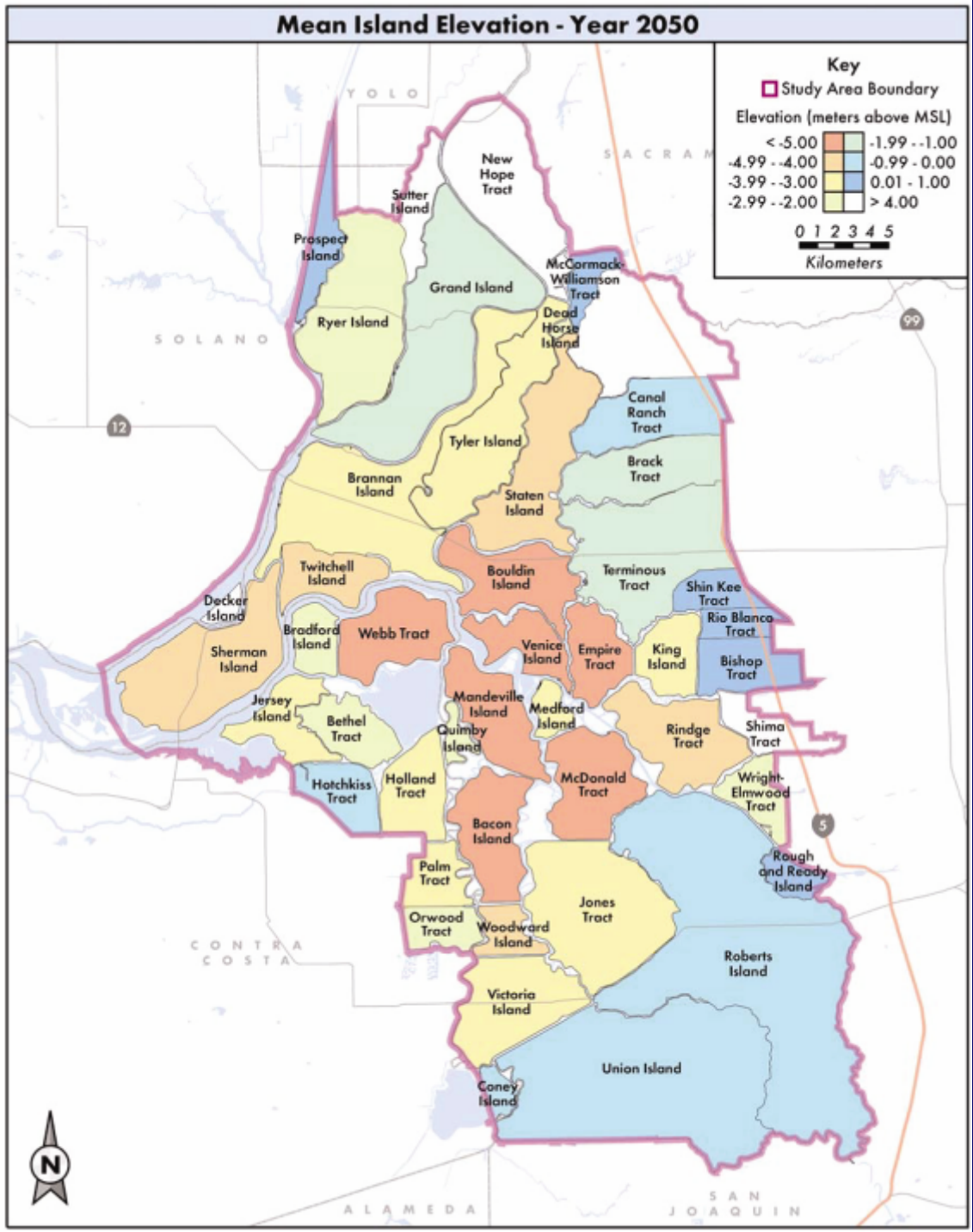
Areas of different land cover types subject to MONTHLY inundation



All categories increase, but big changes are in cropland.


forest
shrubland
barren
developed
grassland
crops
wetlands

But don't forget those "islands" below sea level!



Mount and Twiss, SFEWS 2005

Accurate elevation data permits the calculation of useful information regarding potential levee breaches…

Name	%vol	%prism
Grand Island	10	16
Tyler Island	7	10
Brannan Island	14	18
Staten Island	9	9
Bouldin Island	6	7
Twitchell Island	4	4
Sherman Island	9	13
Webb Tract	6	7
Empire Tract	4	5
Bradford Island	2	3
Venice Island	4	4
King Island	3	4
Mandeville Island	6	7
Jersey Island	2	4
Medford Island	1	2
Rindge Tract	7	9
Bethel Tract	2	4
Quimby Island	1	1
McDonald Tract	7	8
Holland Tract	3	5
Bacon Island	6	7
Palm Tract	2	3
Jones Tract	10	14
Woodward Island	1	2
Orwood Tract	1	3
Victoria Island	5	8

Thanks to Tom Coons for all his work on the elevation dataset. Thanks also to the following who provided essential data: Bruce Jaffe, Amy Foxgrover, Theresa Fregosa, Cathy Ruhl, Brad Tom, Chris Enright, Bill Dietrich, Ionut Iordache, Jeff Mount

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